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Assignment on Massively Parallel Algorithms - Sheet 7

Due Date 25. 06. 2014

Exercise 1 (Line of sight using inclusive max scan operation, *10 Credits*)

Given framework `LineOfSight` generates an image file `"height-field.bmp"` in the framework project directory representing the height map of an arbitrary sine surface and the framework uses `Line of Sight` concept presented in the lecture to generate a coloured ray running diagonally from bottom left to top right in the final output image representing horizontal line of sight, where blue colour represents the points which are visible and red colour represents points which are not visible along the view direction (line of sight ray) see figure 1.

Hint: Please note that in the above framework for simplicity only a single block consisting of max threads (usually powers of 2) supported by respective device is considered.

Your tasks are as follows:

a) Implement a kernel for inclusive max scan operation using `Hillis Steele Algorithm` (single block version) as presented in the lecture.

b) Implement two kernels (one for up sweep and other for down sweep) for inclusive max scan operation using `Blelloch Algorithm` (single block version)

   Hints:

   i) Note that `Blelloch Algorithm` performs exclusive scan operation. So please perform appropriate modifications to generate inclusive max scan result.

   ii) use the utility functions provided in the framework for computing angles from height and for getting location of point on a ray in both `a` and `b`.

   iii) Expected output image is shown in figure 1.

c) Compare run times between the above two implementations (a and b) and provide arguments for the differences/similarities between run times for these two implementations.

d) Write either a pseudocode for Hillis Steele Algorithm to compute inclusive scan of an arbitrary length array or present your ideas to modify Hillis Steele Algortihm for an array of arbitrary length.

Figure 1: Height Field bitmap with coloured line of sight ray where blue points are visible points and red points are non-visible points.